YAKIMA INDIAN NATION COMMENTS ON THE BASALT WASTE ISOLATION PROJECT EXPEDITED SPECIAL CASE (ESC) PACKAGE FOR DRILLING AND PIEZOMETER INSTALLATION AT BOREHOLES DC-23GR, -24, -25, -32 AND 33

AUGUST 6, 1987

ESTABLISHED BY THE
TREATY OF JUNE 9, 1855
CENTENNIAL JUNE 9, 1955

CONFEDERATED TRIBES AND BANDS
Yakima Indian Nation

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GENERAL COUNCIL
TRIBAL COUNCIL

August 5, 1987

Mr. John H. Anttonen, Assistant Manager
for Commercial Nuclear Waste
Department of Energy
Richland Operations Office
P.O. Box 550
Richland, WA 99352

Dear Mr. Anttonen,

The following are the Yakima Indian Nation Comments on the BWIP Expedited Special Case (ESC) package for drilling and piezometer installation at boreholes DC-23GR, -24, -25, -32 and 33. These comments were developed after a review of the two formal requests for restart, and other supporting documents. These documents were required as direct references for the activities constituting the scope of work described in the requests. These direct references reviewed include:

Site Groundwater Study Plan
Stratigraphy Study Plan
Intraflow Study Plan
Test Data Collection Specifications
Design Requirements for Piezometer Facilities
Quality Evaluation Board (QEB) Level Assignments

Additional documents, termed "prerequisite documents" include the BWIP Project Management Procedures Manual (PMPM), Quality Assurance Administrative Procedures (QAPP), and Test and Operation Procedures (TOP). All of the direct references and some of the prerequisite documents have been provided for review in support of an early restart.

The requests for restart and the available supporting documents have been reviewed and evaluated to the degree possible in the short time period provided. Results of this review indicate that the benefits of an early restart have not been adequately shown to outweigh the potential risks, and thus justify a departure from the project restart schedule.

We look forward to meeting with you and your technical staff to clarify and discuss these comments. Please call if you have any questions.

Sincerely,

Russell Jim

bcc: Dr. Vietchau Nguyen
EWA, Inc.

YAKIMA INDIAN NATION COMMENTS

ON THE BASALT WASTE ISOLATION PROJECT

EXPEDITED SPECIAL CASE (ESC) PACKAGE

FOR DRILLING AND PIEZOMETER INSTALLATION

AT BOREHOLES DC-23GR, -24, -25, -32 AND 33

AUGUST 6, 1987

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EXECUTIVE SUMMARY

The Basalt Waste Isolation Project (BWIP) has requested approval from the Department of Energy (DOE) for an early restart of drilling and piezometer installation at boreholes DC-23GR, -24, -25, -32, and -33. A review of the requests for restart and the available supporting documents indicates that an early restart is not justified based on the anticipated benefits and risks. The following conclusions have resulted from this assessment of the BWIP request for restart:

- Earlier availability of data resulting from an early restart will probably not have a significant effect on the timing of suitability determination.

- The emphasis on cost savings is not justified.

- All prerequisite documents will not be completed before drilling begins and were not available for this review.

- The Site Groundwater Study Plan does not address the determination of undisturbed boundary conditions for the controlled area study zone numerical modeling.

- The Site Groundwater Study Plan does not address uncertainties in water-level measurements due to borehole deviation.

- No cores will be taken from the hydrologic test wells, resulting in a lost opportunity to obtain important data, particularly fracture and joint data.

- Stratigraphy, intraflow structure, and geologic structure data needs were not taken into consideration when determining borehole locations.

- Expected results from geophysical surveys outlined in the Stratigraphy Study Plan cannot be obtained using available technology.

- No plans to monitor and measure methane are indicated.

- The Testing and Operation Procedures (TOP) documents lack sufficient QA/QC criteria.

- Most of the documents provided for review are in draft form. The majority of the TOP's necessary for restart were not made available.

I. INTRODUCTION

The BWIP has recently submitted a request for an early restart for drilling and piezometer installation at boreholes DC--23GR, -24, -25, -32, and -33. Two requests for restart, A and B, have been issued along with several documents which are required as direct references for the activities constituting the scope of work described in Section 1.0 of the request for restart. These direct references are:

Site Groundwater Study Plan
Stratigraphy Study Plan
Intraflow Structures Study Plan
Test Data Collection Specifications
Design Requirements for Piezometer Facilities
Quality Evaluation Board (QEB) Level Assignments.

Additional documents, termed "prerequisite documents", include the BWIP Project Management Procedures Manual (PMPM), Quality Assurance Administrative Procedures (QAAP), and Test and Operation Procedures (TOP). All of the direct references and some of the prerequisite documents have been provided for review

in support of an early restart.

The requests for restart and the available supporting documents have been reviewed and evaluated to the degree possible in the short time period provided. Results of this review indicate that the benefits of an early restart have not been adequately shown to outweigh the potential risks, and thus justify a departure from the programatic schedule for the lifting of the stop work order. The following section assesses the requests for restart documents, the Site Groundwater Study Plan, the Stratigraphy Study Plan, the Intraflow Structure Plan, the Quality Evaluation Board (QEB) Assessment, the Test Data Collection Specifications, and the various TOP's which were made available.

II. REVIEW OF DOCUMENTATION FOR THE RESTART OF BOREHOLES DC-23GR, -24, -25, -32, AND -33

A. Requests for Restart A and B

1. Introduction

In September, 1986, BWIP submitted a request for approval to restart the drilling of boreholes DC-24 and -25 on an Expedited Special Case (ESC) basis. This drilling had been in preparation when a Stop Work Order was issued. The restart request was denied by DOE-RL because they felt that a solid QA program for the drilling activities was still not in place, and that site

characterization needs were not well defined or documented with respect to the drilling of these two boreholes. The DOE mandated that a Level 1 QA program be established for these drilling activities; and as a result, BWIP has completely re-evaluated and redone the ESC package with the higher QA requirements in mind.

Restart Request A, submitted in April 1987, contains two major requests. The first was for the DOE to give the BWIP permission to elevate the definition of borehole requirements and facility design development (for boreholes DC-23GR, -24, -25, -32 and -33) to an ESC status. The second request was to restart the work on requirement collection and facility design development under the ESC status.

As part of the BWIP re-evaluation, the site characterization data to be collected in these boreholes have been documented in several draft papers, including the Issues Resolution Strategy, and the three study plans listed above. The design requirements for these boreholes have since been derived from these documents. Additionally, two other new documents are currently being prepared to further define the site characterization data needs. These documents include the Test Data Collection Specifications (TDCS) and the Design Requirements Document (DRD). The TDCS is based on the draft study plans and the Option Paper (the Option Paper describes the purpose and objectives of the pre-ES hydrology program, including the justification and need for the borehole data), whereas the DRD is based on the TDCS and the Option Paper. As the study plans progress towards approval, the

TDCS will be revised to agree with them. The DRD will be revised to agree with the TDCS.

An explanation and justification for an early restart of drilling and piezometer installation at five hydrologic test borehole sites is provided in Restart B, which is dated May 29, 1987.

Both restart documents alternately present the levels of risk and benefit relative to various issues for early restart of drilling.

The following restart issues are based on discussions contained in both documents.

2. Comments

Issue #1: The cost savings resulting from an early restart may not be great enough to balance the associated risks.

Discussion: According to the DOE, one of the main benefits resulting from an early restart is the savings of $40,000 in stand-by rig costs at DC-24. The DOE also asserts that an early restart would save $50 million that would otherwise be incurred due to delays in ES construction and License Application Design (LAD). This assertion assumes that the 19-week schedule reduction applies directly to submittal of the LAD schedule reduction. However, the DOE concedes that "the Exploratory Shaft has other prerequisites that may be more controlling than restart of [the] boreholes..." The link between $50 million in savings and an early restart of

test borehole drilling is not well enough established to be used as a basis for recommending an early restart, and in the context of the discussion is misleading.

Compared to the overall cost of site characterization activities, $40,000 is not an amount that should be used to justify a change in schedule, considering the risk involved.

Issue #2: The risks associated with early restart may be greater than indicated by the DOE.

Discussion: The DOE maintains that the risks associated with an early restart are minimal, and that there is only a "small possibility" that work will have to be repeated. Even a "small possibility" that work will have to be repeated could have a significant effect, depending on the type of work to be repeated, and when a decision is made to repeat that work. If, for instance, data gathered during the pre-ES phase of the program need to be collected again (because they are not suitable for licencing), repeating the work during the post-ES phase will not help provide the desired information needed regarding the hydrologic system. This is particularily the case for data that are perishable in nature and that are needed to establish baseline hydrologic conditions.

Issue #3: The importance of favorable public/political perception as a basis for early restart is overemphasized.

Discussion: Another DOE justification for early restart of drilling is the anticipated favorable public/political perception of such an action. The early restart is expected to have strong favorable support from the technical community. The "technical community" being referred to is unclear since the DOE also anticipates strong negative reaction from "those who have established a negative opinion regarding locating a repository at Hanford." Any decision to restart should have a sound technical basis and should not be motivated by anticipated public/political perception.

Issue #4: Prerequisite documents will not be completed before drilling begins.

Discussion: According to DOE, the restart risk is mitigated by the use of approved procedures and the DOE/subcontractors Evaluation of Readiness that will be conducted after all draft documents have been completed and before drilling commences. However, both restart requests state that "prerequisite documents that are not in place at the time the work begins will be integrated with the completed work when the prerequisite documents are released." These statements are contradictory. At this time, at least 10 of the 16 Test and Operations Procedures (TOP's) reviewed for

this report are still in their draft form. Other documents also currently in draft form include the Study Plans, the TCDS, the DRD, the Project Plan and Charter, the Records Management Plan, the Document Control Plan, the BWIP Configuration Management Plan. Given the July 1, 1987 drilling restart date discussed above, a substantial percentage of the prerequisite documents will not be in final form, and therefore will not be approved, when work commences.

For example, one of the prerequisite documents which is currently incomplete is the "Quality Evaluation Board Level Assignments Expedited Special Case for Restart of Boreholes DC-24 and DC-25". This document sets the QA levels for the items and activities for the boreholes and test facilities. Currently, this document is undergoing technical review, and does not include boreholes DC-23, -32, and -33. Restart Request A states that "the purpose and construction of boreholes DC-23, -32, and -33 are very similar to those of DC-24 and -25; therefore, the QA levels are expected to be the same." This document should be fully completed before drilling commences, because it directly affects the ESC scope of work.

In addition, an early restart would result in the release of the Design Requirements Document (DRD) prior to the release of reviewed study plans and Test Data Collection

Specifications. If the DRD is based on the study plans, the study plans should be in final form before the DRD is utilized.

Issue #5: The restart requests are not correct in stating that higher quality hydrogeologic data will be obtained because the borehole data collection and test design are now being done under QA level 1 status.

Discussion: Collection of borehole and test design data under quality level 1 status will hopefully ensure the traceability of this information. However, traceability does not necessarily guarantee that the data will be of high quality. In addition, because the actual analysis and interpretation of these data is independent of QA level 1 status, the final results may not be of higher quality.

Issue #6: The DOE does not clearly define what constitutes a "completed" or "in place" document.

Discussion: The DOE states that "all prerequisite documents will be completed and reviewed before drilling begins", and that "documents that are not in place at the time work begins will be integrated..." The DOE should specify if "completed" or "in place" refers to a released draft version, an approved but not final version, or a finalized version.

Issue #7: The DOE claims that the earlier availability of data resulting from an early restart will permit earlier determination of site suitability (Request for Restart Document B, p. 11). This may be true if the data were to prove the site to be unsuitable; however, it is anticipated that no such determination will be made by the DOE prior to ES construction and testing.

Discussion: The DOE position at the April 7-9, 1987 Hydrology Workshop concerning determination of site suitability is reflected in the folowing statement: "USDOE does not believe the preliminary tests will produce enough information to determine whether Hanford may be disqualified as a repository site" (Nuclear Waste Update, May 1987). Therefore, it is not likely that an early restart will have a significant effect on the timing of suitability determination, which is not expected to be made for several years. This is particularly true given the uncertainty associated with the geohydrologic system and the tentative nature of schedules and locations presented in the Site Groundwater Study Plan.

B. Site Groundwater Study Plan

1. Introduction

The draft Site Groundwater Study Plan describes the program

of hydrologic tests that will satisfy the data needs of the Issue Resolution Strategies to be presented in Section 8.2 of the Site Characterization Plan. Since Chapter 8 of the SCP has not been released, a complete evaluation of the study plan was not possible. Therefore, this review is limited to the scope of our best current knowledge of the issues to be resolved by site characterization.

The study plan presents an overview of the hydrology program. It emphasizes the part of the hydrologic characterization program that will take place prior to construction of the ES. A description of the post-ES program and the individual test is presented in a more general fashion.

The program is divided into two activity phases based on the timing of the construction of the ES.

The pre-ES phase will be conducted primarily to acquire data that will help accomplish the four objectives of the pre-ES testing described in the option paper. The pre-ES phase will focus more heavily on characterizing a volume somewhat larger than the controlled area. This volume is defined as the controlled area study zone (CASZ).

The post-ES construction phase is divided into two parts: the surface-based testing and the ES-based testing. The stated principal objectives of the post-ES surface-based testing are (1) to obtain hydraulic property ranges and distributions in the CASZ, (2) to determine the hydraulic significance of geologic features affecting groundwater flow in the CASZ, and (3) to

obtain groundwater samples for hydrochemical characterization. The post-ES shaft subsurface-based tests will provide access to the Cohassett flow for the purpose of obtaining hydraulic and solute transport characteristics of the flow interior.

The main weaknesses identified in the Site Groundwater Study Plan arise from the division of the hydrologic program into two activity phases based on the construction of the ES. The construction of the ES also defines two different conditions of the groundwater flow system: undisturbed and permanently altered conditions. Since regulations require the assessment of the groundwater travel time (GWTT) under undisturbed conditions, all parameters needed for GWTT calculations should be determined for undisturbed conditions. Among these parameters, the undisturbed conditions that prevail at the boundary of the CASZ are very critical. The Site Groundwater Study Plan fails to provide any clear strategy to obtain this important piece of information.

2. Comments

Issue #8: The Site Groundwater Study Plan does not address the determination of boundary conditions for CASZ numerical models.

Discussion: In the pre-ES phase, hydraulic head data will be collected at new locations within the CASZ that hopefully will define the undisturbed potentiometric baseline in the CASZ. During the post-ES testing phase, new monitoring

facilities will help define the post-ES potentiometric surface outside of the CASZ. Numerical models for the CASZ will be used in the site performance assessment required for licensing performance application. For the GWTT criterion evaluation, undisturbed hydraulic head field boundary conditions should be used as input to these models to characterize the hydraulic conditions that prevail before disturbance of the system by LHST and ES activities. In order to characterize these boundary conditions, the DOE should study the groundwater flow within a larger area than the CASZ before ES drilling. Since this approach is not planned, and the present DOE strategy is to characterize the two parts of the groundwater system in two separate phases (pre-ES and post-ES), the DOE will have to link the information resulting from these two phases in order to define undisturbed flow conditions at the CASZ boundary. The method by which these pre-ES and post-ES generated data will be combined to properly determine the undisturbed boundary conditions, should be clearly presented in the Site Groundwater Study Plan.

Issue #9: Water-level measurements in piezometers should be corrected for borehole deviations from true vertical.

Discussion: Because of the very low hydraulic gradients in the various confined aquifers, it is crucial that accurate

water-level measurements be made frequently in the piezometers. This requires: (1) extremely accurate riser pipe surveys with respect to other riser pipes; (2) precise water-level measuring instruments; and (3) trained technicians. However, several sources of error are possible in the water-level measurements. First, the error tolerance in surveying the elevations of riser pipes will be 0.1 ft. The second source of error is in the water-level measurement, which has an error tolerance of 0.1 ft. The more serious source of error, however, arises from the 5 degree tolerance in the borehole deviation from true vertical. For instance, a deviation of 5 degrees will produce an error of 1.53 ft in the measured water table depth of 400 ft when steel tape is used for measurements.

With this type of uncertainty, and with the very small hydraulic gradients expected in the confined aquifers, it would be almost impossible to delineate groundwater flow conditions and accurately estimate gradients. Corrections that account for the borehole alignment must be made to reduce the present uncertainty.

Issue #10: The Study Plan does not clearly explain the procedure by which alternate conceptualizations at the flow systems will be ranked and the "preferred" representation will be identified.

Discussion: The study plan discusses the method by which integrated information will be used to generate a suite of alternate flow system representations consistent with the available data. Quantitative evaluation will be made by building numerical models based on each conceptualization. The constraints upon the conceptual model are in the form of "hard" data which provide reference points to which the qualitative representation of the conceptual model must adhere as closely as possible.

This way of proceeding appears to be direct. However, the actual process is not as direct as is suggested in the study plan. For instance, many parameters are inferred from raw data obtained during testing. The parameter inference generally is already based on a conceptualization of the system (e.g., porous medium versus fractured medium for pumps and tracer test, density effect negligible for hydraulic head measurement, etc.). In addition, numerical models that are used to analyze test data and ultimately used to rank the preferred conceptual model have non-unique solutions. For the same conceptualization of the system, as it is adequately stated in the study plan, different values of the investigated parameters may be obtained. Additional parameter values are obtained when using alternate conceptualizations of the hydrologic system.

Due to the difficulty of answering the questions raised

above and the dramatic consequences that a "preferred" conceptualization may have, the DOE should be more explicit and present clearly the selection process that will be used.

Issue #11: The study plan contains an incorrect assumption regarding the rates of water extraction during and after construction of the exploratory shaft testing facilities.

Discussion: It is stated that the rate of water extraction that will have to be maintained to keep the exploratory shaft facilities at atmospheric pressure will be similar to the rates of the LHS test pump. It is not clear why such an analogy is made. While the rate of water extraction per unit of borehole/test facilities interior surface area can be assumed to be of the same order, this situation cannot be true for the global yield since the yield of water extraction is proportional to the area through which water can flow.

Issue #12: The only valid justification for an early restart is not considered in the request for restart document.

Discussion: An early restart would be better justified if plans had been made to gather additional information. DOE could have planned to conduct testing while drilling DC-24, -25, -32, and -33 on a drill and test basis. These tests would

provide a way to refine the geostatistical properties of the local hydraulic conductivity/transmissivity field in the CASZ. Such information is needed for an early determination indication of the presence of the groundwater travel time disqualifying condition.

Issue #13: The study plan does not adequately discuss verification of measured pumping rates.

Discussion: On page 32, paragraph 3, it is stated that: "the accuracy needed for pumping rates will vary according to the magnitude of the rate and is therefore set at +/- 5% of the measured rate." It is not clear how the measured pumping rates can be verified and whether redundant flow measuring devices will be used to verify this variance. Finally, DOE should provide the rationale for selecting this specific variance value (+/- 5%).

Issue #14: Not enough detail is provided to assess the efficiency of tracer tests.

Discussion: The hydrogeology study plan does not provide the detail necessary to determine whether tracer tests and the data generated from them are useful, or whether such tests can be undertaken. Options are given for when and how the tracers will be introduced, but no information is given regarding data analysis or potential problems that might

occur. Because they are an integral part of the overall hydrologic testing program, the tracer test plans should be released in a timely fashion to allow review and input by the affected parties.

Issue #15: Drilling the ES through suprabasalt sediments before LHST may result in undue perturbations of the unconfined aquifer and contamination of the ES.

Discussion: The ES is situated to the west of the 200 West Area. Under the 200 West Area is an extensive groundwater mound, formed primarily by radioactive water infiltrating through the unsaturated suprabasalt sediments from the U Pond. Other disposal sites are present in the 200 West Area, as well. The radioactive components are primarily tritium and beta emitters (mostly as Ru-106). Non-radioactive nitrate is also present. The plumes from the U Pond groundwater mound are migrating southeast at present, but a considerable amount of contaminated water remains near the 200 West Area because of the relatively low transmissivities in the Ringold Formation in this vicinity.

A map in Gephart et al. (1979) shows that the groundwater mound under the U Pond has extended west, under the ES site (the U pond is only about one mile east of the ES site). The water table under the ES has risen 40 to 60 feet since 1944. By drilling the ES down to the top-of-basalt surface,

the potential exists for creating a large groundwater sink, if water in the ES is pumped out. Such a sink will likely cause a change in the local hydraulic gradient. This sink is likely to expand the longer the unfinished shaft is kept in place. Contaminated groundwater under the U Pond can begin to migrate west toward the shaft, causing the shaft to become filled with water containing radioactive solutes. There appears to be evidence of westward migration of contaminants already. Well 699-37-82A, less than 0.5 miles from the ES site and about 0.75 miles from the U Pond, was noted in 1981 by Graham to have a tritium concentration in the groundwater of 1.02 pc/ml. Graham (1981) notes that many of the wells in the separations area are screened near the water-table surface and contaminant sinking has been observed to be associated with mounding. Therefore, the contaminant concentration noted here may be a lower bound.

The ES site is in the vicinity of Cold Creek, which acts as an infiltration gallery for the entire unconfined aquifer. The effect of introducing a large groundwater sink for an extended period of time may perturb groundwater flow throughout the aquifer and alter the pattern of contaminant plumes. Because the ES site is in a recharge area, greater than normal inflows might be expected in the shaft, and pumping would be necessary on a frequent or continous basis. The alternative would be to pump the water into settling ponds, creating yet another groundwater mound in the area

and altering flow patterns in the unconfined aquifer even further.

References:

Gephart, R.E., R.C. Arnett, R.G. Baca, L.S. Leonhart, and F.A. Spane, Jr., 1979, Hydrologic Studies within the Columbia Plateau, Washington: An Integration of Current Knowledge, RHO-BWI-ST-5, Rockwell Hanford, Richland, WA.

Graham, M.J., 1981, Hydrology of the Separations Area, RHO-BWI-ST-42, Rockwell Hanford Operations, Richland, WA, 89 p.

C. Intraflow Structures Study Plan

1. Introduction

The draft Intraflow Structure Study Plan discusses the activities associated with borehole correlation of intraflow structures, including the testing and interpretation which will be done in conjunction with new and existing boreholes in the Pasco Basin. This document is based partially on the Intraflow Structure Plan, as well as on the draft Stratigraphy and Site Groundwater study plans and the Option Paper.

Intraflow structure studies will be conducted at all boreholes drilled for the various programs, i.e., hydrology, hydrochemistry, and geology.

2. Comments

Issue #16: No cores will be taken from the planned hydrologic

test boreholes.

Discussion: A high degree of uncertainty has been associated with much of the intraflow structure data determined by downhole geophysical techniques. While improved geophysical logging techniques will be developed as part of site characterization, these techniques will probably not be available for use in the boreholes to be drilled for pre-ES hydrologic testing. Cores would provide additional intraflow structure information to supplement that gained from geophysical methods. Even more important, cores would provide much needed fracture and cooling joint data which cannot be obtained from geophysical methods at this time. By not taking cores in these boreholes, the DOE is losing the opportunity to gain important information necessary for site characterization.

D. Stratigraphy Study Plan

1. Introduction

The Stratigraphy Study Plan discusses the activities necessary to provide stratigraphic data for the repository site, CASZ, Cold Creek syncline, Pasco Basin, and vicinity. Stratigraphic knowledge will be used as a basis for many of the BWIP studies including structural model development and groundwater flow system definition. Stratigraphic data also will influence repository layout design as well as borehole and shaft

seal design and placement.

The Stratigraphy Study Plan discusses, in general, its plans for acquiring additional seismic reflection and downhole geophysical data in the CASZ. The BWIP plans extensive two- and three-dimensional seismic surveys for fiscal years 1987 and 1988 and perhaps beyond. These surveys are designed to image the sediments and basalt to a depth of 500 m or greater. The BWIP intends to use these data to determine how seismic reflection data may be used to map the subsurface to a depth of 1500 meters.

The BWIP intends to perform a preliminary test of the three-dimensional seismic reflection method in the northwest corner of the CASZ during fiscal year 1987. This preliminary test is designed to provide acquisition parameters for further three-dimensional seismic reflection testing in fiscal year 1988. From the fiscal year 1988 test results, BWIP will decide whether to:

(1) abandon the three-dimensional seismic reflection survey due to poor results, or

(2) run the survey using the acquisition parameters giving the best results in the test.

If test results are acceptable, the BWIP will run the three-dimensional survey in stages, with about one survey per year. The deadline for project completion is before the advent of the sinking of the exploratory shaft. In conjunction with the three-dimensional surveys, a high density two-dimensional seismic reflection survey will be conducted within the CASZ wherever three-dimensional data are not collected. The survey is to be set up in a grid pattern using 62 lines spaced 500 meters apart.

The higher resolution three-dimensional seismic survey within the RRL will be merged with the lower resolution high density two-dimensional survey to image the CASZ subsurface.

2. Comments

Issue #17: The Stratigraphy Study Plan does not address sub-basalt strata.

Discussion: The omission of sub-basalt strata from the scope of the Stratigraphy Study Plan is a reflection of the seemingly disinterested attitude towards these rocks. Knowledge of sub-basalt strata is very important for structural geology/tectonic studies and natural resource assessment. In addition, the deep groundwaters within the sub-basalt sedimentary rocks could be a recharge source for the groundwater flows in the basalts. Therefore, to be complete, the Stratigraphy Study Plan should include a discussion of plans to characterize the sub-basalt strata. This would allow the study plan to more clearly meet the objectives of site characterization.

Issue #18: The Stratigraphy Study Plan implies that all basalt layers are to be imaged.

Discussion: The study plan states, "Utilizing the proper acquisition and processing techniques, the problems can be solved and the basalt layers in the CASZ can be imaged" (p.

40). While it may be true that some of the basalt layers can be imaged, the study plan does not provide sufficient detail of the procedures for data acquisition and processing to support the idea that all basalt layers can be imaged.

In order to successfully image the basalt layers, two subsurface requirements must be met. The first is that each individual flow top must be sufficiently thick to be distinguishable from the layers above and below. The second requirement is that velocity and density contrasts be great enough between adjacent layers to generate a reflection that is detectable on the record section. Some of the thicker flows may be detectable.

Issue #19: The Stratigraphy Study Plan is overly optimistic with respect to the expected quality of seismic survey results.

Discussion: In Section 3.2.2.4, the study plan describes seismic resolutions expected relative to the quality of the survey results. "It is expected that the survey results will not be of excellent quality unless the BWIP makes a significant breakthrough in the quality of seismic acquisition and processing." For excellent quality results, features with seismic expressions on the order of 5 to 25 meters should be resolvable.

The definitions of quality provided in the study plan are

- Survey Results of Average Quality (i.e., slightly better than now available). Features with seismic expressions on the order of 30 to 100 m should be resolvable.

- Survey Results of Good Quality. Features with seismic expressions on the order of 15 to 40 m should be resolvable.

- Survey Results of Excellent Quality. Features with seismic expressions on the order of 5 to 25 m should be resolvable.

Unless the following problems can be solved the results may not even be of good quality:

(1) A high velocity layer within the suprabasalt sediments causes channeling of low velocity energy near the surface.

(2) The above mentioned layer has large features causing statics problems.

(3) Velocity variations in the sediment cause scattering of seismic energy.

(4) Problems of source and receiver coupling exist.

(5) Alternating high and low velocity layers of the basalts and interbeds cause a high attenuation of seismic energy (Stratigraphy Study Plan, p. 39-40).

Issue #20: It is questioned whether software of the sophistication used in seismic processing can be developed in the time frame given.

Discussion: Project requirement 2 on page 43 states that processing tools such as surface-consistent statics and ray-trace statics must be developed or acquired to adequately process the data. The BWIP plans to begin the three-dimensional seismic testing in summer of 1987. If the

necessary processing software cannot be acquired, then it must be developed. In this event, it is doubtful that the software would be developed before the scheduled seismic testing.

Issue #21: The study plan has an overly optimistic view that strata and structure can be mapped to a depth of 1500 meters.

Discussion: The expected results of the 3-D seismic project are that the "acquisition of seismic reflection data will image the sediments and basalt to a depth of 500 meters or greater. In addition, data will be acquired that will allow the BWIP to determine how to use seismic reflection data to map the strata and structure to a depth of over 1500 meters" (p. 44). These statements are not substantiated by any technical references. In order to map the CASZ subsurface at depth, the problem of energy loss within the basalts and the sedimentary interbeds must be solved. If the BWIP intends to make use of a previous similar survey to arrive at the 1500 meter depth, the study plan should make reference to it.

Issue #22: It is recommended that the parameters for the actual three-dimensional seismic reflection survey be readjusted using FY 88 final parameters.

Discussion: In section 3.2.3.3 (p. 45), the study plan describes the data acquisition for the three-dimensional seismic reflection survey. Acquisition parameters are to be determined during the processing of the preliminary three-dimensional test data. The study plan states that these parameters are to be chosen during the processing of the preliminary three-dimensional test data collected in FY 87. Since the BWIP will perform additional testing in FY 88, it is recommended that the parameters for the actual survey be readjusted using the data of the FY 87 data.

E. Testing and Operation Procedures (TOP) Documents

1. Introduction

The Testing and Operations Procedures (TOP) documents provide standard procedures to be followed in the performance of various tasks related to the LHST. The tasks for which TOP's are created include drilling, geophysical logging, hydraulic head monitoring, and groundwater monitoring.

The main issue of concern identified in the TOP's deals with the unavailability of important information and the lack of sufficient QA/QC procedures regarding borehole drilling, preparation, development, and sampling.

2. Comments

Issue #23: Many of the prerequisite TOP documents are unavailable for review.

Discussion: Of the eighteen TOP's made available for critical review, ten were draft reports. All draft reports should be finalized prior to commencement of restart activities. This is important because performance of restart activities based on draft reports may result in invalidation of collected data, unsafe practices, and lost time due to backtracking and implementation of changes. Furthermore, it is difficult to review the overall program based only on the eighteen TOP reports made available. A total of fourty-six additional TOP documents exist and have not been provided; hence, a comprehensive assessment of the overall restart program cannot be performed.

Issue #24: The TOP's do not provide adequate QA/QC procedures to ensure the integrity and quality of the cement seals.

Discussion: The cement seals are essential to prevent the intercommunication of unique groundwater systems in the borehole. When computing the amount of cement necessary to fill a given interval with cement, anomalous porosities (e.g., fractures) are not considered. If such anomalies are not incorporated into the calculation, the distribution of the cement cannot be assured. Furthermore, although the TOP's do discuss geophysical testing of the integrity of the

cement seals, corrective actions are not discussed should the seals prove to be inadequate.

Issue #25: The TOP documents lack sufficient QA/QC criteria with regards to development and sampling of the boreholes.

Discussion: It is specified in the Requests for Restart A and B that higher quality hydrogeologic data will be obtained as a direct result of the higher level of QA requirements; however, the TOP's do not reflect this higher level of QA/QC requirements. The TOP's do not provide sufficient information regarding sampling frequencies or procedures to ensure adequate decontamination and cleaning of sampling equipment. In addition, the relevant TOP's do not describe calibration methods for important geophysical and geochemical equipment (i.e., neutron probe and pH meter), but rather rely on the manufacturer or the contractor calibration methods. This may pose serious problems of (1) standardization, (2) applicability of the calibration results (i.e., see comment #36), and (3) traceability.

F. Quality Evaluation Board Level Assignments, Expedited Special Case for Restart of Boreholes DC-23, -24, -25, -32, and -33

1. Introduction

This document contains the Quality Evaluation Board (QEB) assessment of items and activities associated with piezometer

facilities. These items and activities have been assigned quality levels based on the level of control necessary to meet standards for licensing suitability determination.

2. Comments

Issue #26: The QEB document does not discuss plans to monitor and measure methane in the boreholes to be drilled.

Discussion: The QEB report states, "Drilling history at Hanford has not shown natural gas (methane) to be a problem... Monitoring for natural gas production is a common way to mitigate unforeseen adverse situations" (p. 18). Measurements of methane in groundwaters at Hanford have shown relatively high concentrations in some boreholes. Some concentrations may be as high as 90% or more (Early, 1986). Consequently, the potential exists for problems in the drilling of future boreholes. This document does not contain any further reference to monitoring for natural gas, and the other restart documents reviewed also do not indicate plans to monitor and measure methane. A BWIP document (Early, 1986) has recommended that new methane sampling and analytical procedures be adopted for future borehole drilling. According to Early (1986), "The BWIP recently procured several downhole sampling devices capable of collecting dissolved gases in situ. Addition of a more reliable gas extraction process and analysis both by gas

chromatograph and mass spectrometric techniques should greatly improve future measurements." It is important that all boreholes be tested for methane, both for safety reasons and also to provide information regarding the hydrocarbon potential of the area.

Reference:

Early, T.O., 1986, Concentrations of Dissolved Methane (CH4) and Nitrogen (N2) in Groundwaters from the Hanford Site, Washington: SD-BWI-TI-296, Rockwell Hanford Operations, Richland, Washington, 30 p.

Issue #27: The GEB report fails to recognize the adverse consequences of borehole deviation relative to water-level measurement accuracy.

Discussion: The GEB assessment identifies borehole deviation as a possible failure during rotary drilling. According to this document, the possible consequences of a nonvertical hole are difficulty in completing the borehole to a predetermined depth and problems in setting and cementing casing.

A more important and likely consequence of borehole deviation is the uncertainty that a nonvertical hole introduces to water-level measurements. Uncertainty could have serious implication for groundwater flow studies. Therefore, correction for borehole plumbness should be made to reduce this uncertainty (i.e., see comment #9).

Issue #28: The QEB considers the presence of voids in the casing cement to be of minor importance even though such voids could allow undesirable communication of groundwater in the Saddle Mountain Basalt and the suprabasalt sediments (p. 72). Subsequently, this item was given a quality level rating of 3.

Discussion: Aquifer intercommunication in the upper part of the section may not have a great effect on borehole objectives or on waste isolation. However, such an occurrence could result in problems relative to environmental monitoring of site characterization activities and the Hanford Reservation, in general. Much of the unconfined aquifer system in this area is highly contaminated from previous Hanford waste management practices.

Issue #29: The QEB assessment of drill cuttings is unclear and inconsistent.

Discussion: The geologic information from drill cuttings will be used as input to stratigraphic and structural models and for creating borehole geologic logs (p. 86). Drill cutting sampling is given a quality level rating of 1, but borehole geologic logs are rated as a level 3. The lower rating assigned to the geologic logs is apparently due to the fact that these logs are to be used for informational purposes

only, not for site characterization.

In the Request for Restart B, one of the activities listed for interpreting stratigraphy and intraflow structures in order to select piezometer installation depths is review of geologic logs. If, as the Request for Restart indicates, the geologic logs will be used to help select piezometer depths, then these logs should have a quality rating of 1. The QEB does not recognize the use of drill cuttings as a method to help determine piezometer installation depths. However, it does state the following: "Cuttings will be used to verify test horizons by chemical analysis. Verification takes place after piezometers are installed" (p. 86).

G. Test Data Collection Specification (TDCS)

1. Introduction

The Test Data Collection Specification (TDCS) document for drilling, logging, and piezometer installation at boreholes DC-23GR, -24, -25, -32, and -33 is in working draft form. This document details the requirements to be used for data acquisition, drilling, and piezometer installation at DC-24, DC-25, DC-32, and DC-33. DC-23GR has already been drilled; therefore, this document applies only to piezometer installation at this borehole.

2. Comments

Issue #30: Stratigraphic, intraflow structure, and geologic structure data needs were not taken into consideration when determining borehole locations.

Discussion: The hydrologic test borehole sites were chosen solely on the basis of hydrologic data needs. While it is crucial that the borehole location meet the objectives of the hydrologic characterization programs, other data needs should also be considered. Such considerations should be possible without endangering the primary goals of the hydrology characterization. It is important that all boreholes drilled for site characterization be located so as to provide the optimum amount of data, regardless of their primary purpose.

Issue #31: The TDCS document consistently refers to the TOP's in a general fashion rather than providing specific references in order to qualify and quantify procedures.

Discussion: The failure to indicate specific TOP's makes assessment of the overall restart program difficult and does not allow verification of the TDCS/TOP references.

Issue #32: The TDCS document indicates that all TOP's must be in place prior to the commencement of drilling operation; however, the TDCS document does not indicate that all TOP's

should be in finalized form.

Discussion: It is highly recommended that all TOP's be finalized prior to commencement of drilling operations. Furthermore, it is recommended that the level of QA/QC presented in the TDCS document be upgraded to a degree that will ensure the integrity of the data. For example, it is stated in the TDCS that "Efforts to exercise control of drilling fluids losses and gains shall, however, at all times be balanced against the objective of successfully completing the borehole." This statement indicates that fluid losses and gains are of minor concern relative to the continuing operation and timely completion of the boreholes. Since the quality of hydrologic and geochemical data can be adversely affected by the presence of drilling fluids, actions should be taken to minimize drilling fluid losses and gains. In fact, mitigative actions should be proposed and documented for all cases in which operations may not meet specified requirements.

Issue #33: Poor packer and sealing integrity may affect the quality of hydrochemistry and piezometer data.

Discussion: The TDCS document states that there are three alternative designs for multi-piezometer installation. For each of these designs, the integrity of the packer and

sealing quality is in question (TDCS, p.14). Faulty packer seals could result in aquifer cross-contamination which would have adverse effects upon the representativeness of the hydrochemistry data. Furthermore, an interconnection between tested units due to a lack of packer integrity would render the piezometer data highly questionable.

Issue #34: The TDCS states that standardization, calibration, acquisition, and display of neutron logging data must conform to API standards as defined in API RP 33-74, Recommended Practice for Standard Calibration and Format for Nuclear Logs. In the neutron logging TOP's, no reference is made of this document.

Discussion: It is not known whether API RP 33-74 was used in formulating the standards for calibration, acquisition, and display in the TOP's pertaining to neutron logging. The standards used must be consistent in both sources.

Issue #35: The TDCS includes a calibration technique for the three-and four-arm caliper that is not included in TOP GT-ES-310, Field Set-Up, Calibration and Operation of the Four-Arm Caliper and Gamma Ray Tool String.

Discussion: The TDCS notes that a check on calibration of the caliper may be performed in cased intervals with known

casing diameters and that borehole diameters measured shall be within 5% of the known casing size. The TOP does not mention this calibration check at all and hence does not use the + 5% tolerances. This additional check on calibration should be described in the TOP.

Issue #36: The porosity measured by the thermal neutron tool is highly questionable because calibration curves may be inadequate.

Discussion: The TDCS states that BWIP has established a maximum total core porosity of 26%. Through compensated thermal neutron porosity logging, Gearhart Industries has measured total porosities as large as 37%. The TDCS states that the discrepancy between core-measured porosities and porosities derived from thermal neutron logging may be due to high iron content and that a plan for quantifying iron effect on neutron porosity will be provided in the appropriate TOP's. An important factor that may be the cause of such discrepancy and which has not been stated in the TDCS is the presence of methane in water. Hydrogene atoms from the methane molecule (as well as the ones from the water molecule) are likely to interact with neutrons. Since calibration of the neutron tool is done with a limestone saturated with water, correction for the presence of methane is not accounted for. This could be a plausible explanation

to the higher porosity inferred from neutron measurements. The presence of methane could even jeopardise the use of the thermal neutron tool to provide reliable estimate of porosity since the concentration of methane is not uniform thoughout the Basalt layers.

III. CONCLUSIONS AND RECOMMENDATIONS

The benefits of an early restart do not outweigh the risks taken by the DOE. The greatest risk of an early restart is that the generated data could be inadequate for liscensing purposes. Depending on if and when a decision is made to repeat the data collection task, the new generated data may not provide the desired information concerning the hydrologic system. This is particularly the case with data that are perishable in nature and are needed to establish baseline hydrologic conditions.

The potential risk described above results from the incompleteness of the supporting documentation package provided for this review. Much of this documentation is in draft form. A comprehensive assessment of the restart documents was impossible because a majority of the TOP's were not made available. The TOP documents that were provided showed inadequate and incomplete QA/QC procedures needed for the restart of the proposed activity.

Supporting documents to the early restart request have been also reviewed. Major and minor inconsistencies in the DOE site characterization strategy have been identified. The main inconsistency arises from the exploratory shafts' construction

prior to the determination of all undisturbed parameters/ conditions that are needed in performance assessment studies for the site. The DOE should consider gathering additional information needed for performance assessment studies (e.g., flow conditions at the CASZ boundary) during the pre-exploratory shaft phase of the program.

In addition, because serious problems would arise in the intepretation of groundwater flow movement from water-level data, correction for lack of borehole alignment should be accounted for.

Other major inconsistencies in the pre-ES site characterization program pertain to the sacrificing of data that needs to be collected during the drilling of DC-24, -25, -32, -33 for the sake of avoiding the delay of the exploratory shaft sinking. In so doing, the DOE misses its opportunity to collect valuable data (e.g., cores, hydraulic conductivities and hydraulic head in non targeted layer, etc.). Revision of the testing program is therefore recommended to accomodate other objectives and requirements of site characterization.

TO: DCC FOR DOCKETING

CONFEDERATED TRIBES AND BANDS OF THE YAKIMA INDIAN NATION
TOPPENISH, WASHINGTON
NUCLEAR WASTE PROGRAM

DOCUMENT TRANSMITTAL DATE August 24, 1987

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These documents are being provided to you for your information and use. Should you have any questions/comments please advise.

DOCUMENT	DATE	DESCRIPTION
1.	08/06	Comments of the Yakima Indian Nation on the Basalt Waste Isolation Project Expedited Special Case (ESC) Package For Drilling and Piezometer Installation at Boreholes DC-23-GR, -24, -25, -32 and 33

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